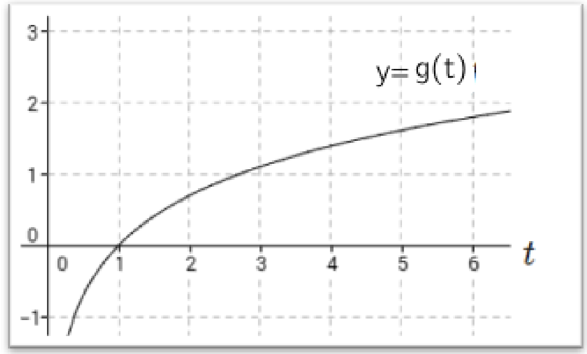
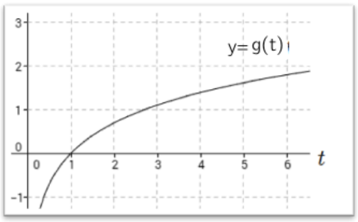
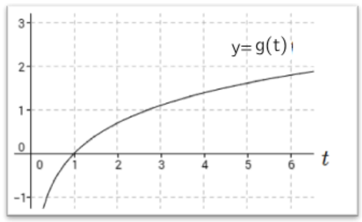
The Fundamental Theorem of Calculus

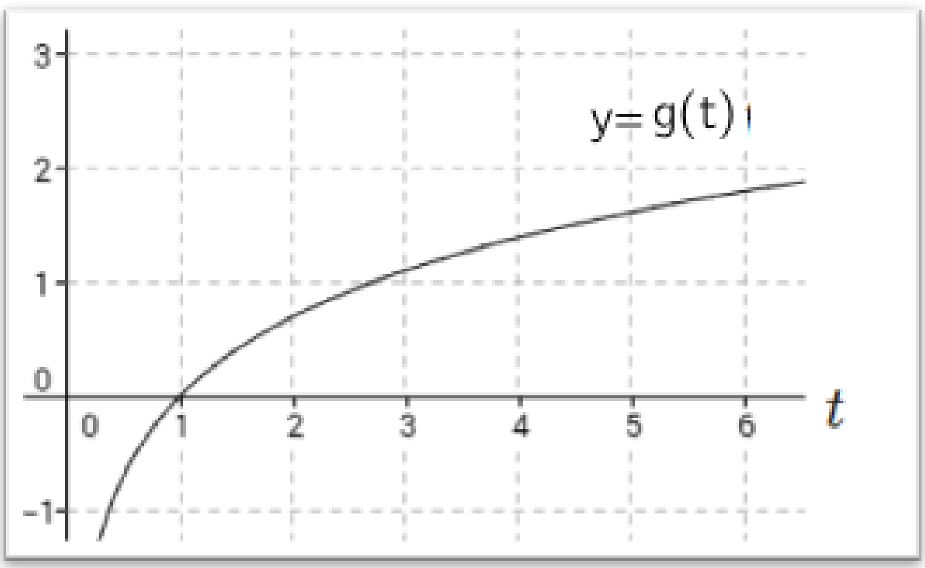


Let $f(x) = \int_a^x g(t)dt$ for the graph of g(t) shown.
So sketch in $f(3)$ and $f(6)$





Let us investigate an "increment" of the area. Namely, the part added on between when you move from a value of x a value of $x + \Delta x$



Find use geometry to find the area of the incremental "rectangle"

(1)

Find the area using the accumulation function.

(2)

Since they both describe the same space, items (1) and (2) should be equal. So:

By Riemann definition $\lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\Delta x = \int_a^b f(x)dx$. So, integration computes area.

By the result on the bottom of the last page: derivative is the inverse of integration.

By common sense (construction) the derivative is the inverse of the antiderivative.

THEREFORE:

FTC Part 2

Now, why is this true: $\int_a^b g(x)dx = f(a) - f(b)$

Let $f(x) = \int_a^x g(t)\, dt$